

REVIEW AND APPROVAL

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7-5-95
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7-6-95
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INTRODUCTION

Located on the "elbow" of Cape Cod, Massachusetts, Monomoy National Wildlife Refuge consists of 2,750 acres of barrier beach island habitat that includes woody scrub, fresh and salt water marsh, and dunes. The refuge was established in 1944 under the Migratory Bird Conservation Act for the perpetuation and protection of migratory waterfowl.

Ninety four percent of the refuge was designated a Wilderness Area in 1970 and is managed under the guidelines of the 1964 National Wilderness Act. It is the only Wilderness Area in southern New England.

Monomoy NWR has one of the greatest diversities of coastal birds in the eastern United States. Approximately 285 species of birds have been observed on the refuge and forty-nine species nest here. The variety and great numbers of birds that can be seen year-round make it a well-known destination for birders nationwide. Marine mammal enthusiasts also enjoy the large concentrations of wintering harbor and gray seals that haul-out on refuge beaches.

Visitor contact facilities consist of a renovated Coast Guard station located on the mainland on Morris Island, the only portion of the refuge accessible by car. This multi-purpose headquarters building offers limited interpretive displays and a branch outlet of the SuAsCo/Great Meadows NWR bookstore.

Historic Monomoy Light, located on South Monomoy Island, is accessible to visitors through guided tours with the Cape Cod Museum of Natural History. The Museum's use of the Light is authorized by a cooperative agreement with the Service.

Access to North and South Monomoy Islands is by boat only. Visitors arrive by private vessel or aboard commercial tour boats. Visitor use is seasonally restricted to protect wildlife and habitat in accordance with the Refuge's Master Plan.

1993 NARRATIVE REPORT:
Monomoy National Wildlife Refuge

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A. HIGHLIGHTS

Rare sighting of a black-tailed godwit in July drew birders from as far away as California. (G.5)

Several articles appeared in local papers concerning the anticipated closing of the Chatham weather station located on refuge property. (I.8)

Four pairs of piping plovers made nest attempts on South Monomoy Island. (G.2)

The Friends of Monomoy submitted a Challenge Grant project proposal. (D.6)

Journalist North Cairn spent four weeks at the lighthouse on special assignment for the Cape Cod Museum of Natural History. (J.1)

B. CLIMATIC CONDITIONS

The surrounding ocean is an important influence on Monomoy's climate. Both winter and summer temperatures are more moderate than nearby inland areas, averaging 67 degrees fahrenheit in July and 32 degrees fahrenheit in January. Average precipitation, mostly in the form of rain, is approximately forty-five inches per year.

1993 significant weather events:

- February 19 storm, labeled the "Great Ocean Effect Snowstorm" by the National Weather Service; this storm dumped twenty-four inches of snow on outer portions of Cape Cod, including Chatham.

- March 13 East Coast Blizzard; this storm brought only two inches of snow to Chatham but the accompanying 70-74 mph winds caused severe beach erosion and flooding.

Forty-two inches of precipitation was recorded in 1993, falling just short of the yearly average for the area. A whopping fifty-five inches of snow was also recorded, thirty eight inches in February alone. The stretch of dry and sunny weather that lasted nearly the entire summer will long be remembered by locals and tourists. This August was the driest on record with little more than one quarter inch of rain recorded. December was also exceptional. It was noted as being very windy, with gale warnings (winds of 39-54 mph) issued nearly every weekend. Ice floes in Stage Harbor locked in fishing boats as temperatures hovered around freezing during the last two weeks of the month. The harbor has not iced over to this extent since the winter of 1990.

Local rumors that a break in South Beach had occurred during a northeaster storm in December were also noted. Although a break was not actually documented, a narrow section that frequently washes over during storms and lunar high tides is showing signs of wear.



South Beach, a nearby barrier beach that protects refuge property on the mainland, shows signs of wear from recent winter storms. (MNY-93, B.Tague)

D. PLANNING

1. Master Plan

The master plan currently used to guide refuge programs was approved in 1988.

5. Research and Investigations

Researcher Valerie Rough was issued a permit to continue her study of grey seals and newborn pups on South Monomoy Island. Unfortunately, the seals did not opt to pup on the refuge this year. In fact, 1991 was the last time pups were born on the island. Instead, Rough monitored seals on Muskeget Island, approximately 15 miles southwest of the refuge. The Muskeget colony produced a record number of 30 pups in 1993.

Blair Nikula was issued a permit to enter closed areas while conducting shorebird surveys during the spring and fall migrations. Nikula submits his data to the International Shorebird Survey located at Manomet Bird Observatory. The refuge is also provided copies of the surveys.

Nikula's observations for the season were highlighted by the sighting of a black-tailed godwit on North Monomoy Island on June 23. Normally found in Eurasia, this bird has only been recorded in the continental United States on a few occasions. This was the first sighting ever recorded on the refuge. Its presence caused a frenzy among life-list birders and a bustling demand for ferry service that lasted about three weeks.

Wallace Bailey was issued a permit to continue an independent study of migrant whimbrels (Numenius phaeopus) using North Monomoy as a staging and roosting area. Bailey et al conducted evening observations from July 11 through September 4, 1993. The number of whimbrels peaked at 557 individuals on July 31.



The presence of this migrant black-tailed godwit on North Monomoy drove life-list birders, as well as refuge staff patrolling the area, wild for three weeks this summer. (MNY-93, B. Nikula)

6. Other

The Friends of Monomoy became officially established as a non-profit group in May. Board members utilized refuge headquarters to conduct monthly meetings which ROS Ware attended as scheduling allowed.

Refuge staff worked with the Friends in developing and submitting a project proposal to the Service's Challenge Grant Program in October. In the proposal, the Friends committed approximately 1,000 hours of labor to construct steps and a viewing platform along an existing beach access on Morris Island. The project was accepted for funding in FY-94, making it their first official venture on behalf of the refuge. ROS Ware also provided the group with an informal refuge gifts catalog to assist in setting future donation and fundraising goals.

E. ADMINISTRATION

1. Personnel

- a. Sharon Ware, Refuge Operations Specialist, GS-9, EOD 07/08/91, PFT.
- b. Stephanie Koch, Refuge Manager Trainee, GS-4, EOD 05/29/93, CFT. Completed first cooperative training session August 28. Scheduled to return for second co-op session September 1994.



ROS Ware (left - 1.a), Volunteer Butley, and RM Trainee Koch (right - 1.b) enjoy a Coast Guard escort to the islands. (MNY-93, D.Scott)

Staff Training in 1993:

- ROS Ware attended Basic Refuge Law Enforcement February 1 through April 9 (Glynco, GA).
- ROS Ware attended Refuge Officer Basic School August 9 through August 20 (Glynco, GA).
- ROS Ware received CPR recertification in August (Great Meadows NWR).
- Defensive driving training in the form of a National Safety Council video and study guide was provided for ROS Ware, Trainee Koch, Volunteer Landess, and Volunteer Scott in July.
- ROS Ware attended drug training for LE officers on October 19 (Augusta, ME).
- ROS Ware attended Visa Government Credit Card training on June 16 (Hadley, MA).

3. Volunteer Programs

Twenty-one individuals contributed 805 hours of assistance with maintenance, resource protection, public use, and administration. Some highlights included defensive driving training, expansion of opportunities to include weekend

tern/plover wardens, and a field trip to Wapack NWR in New Hampshire for the annual Volunteer Day event (see Great Meadows narrative for details).

Volunteers Gordon Landess, Don Scott, Sandy Gadowski, and Brian Tague led the way in providing interpretive assistance. Their collective efforts included staffing the visitor contact station, writing natural history articles for the newsletter, and contacting visitors in the field to explain beach and marsh closures for nesting birds. Many other volunteers applied their skills to a variety of "behind the scenes" projects, providing essential support with posting seasonal closed areas, wildlife surveys, and general maintenance of refuge headquarters and boats.



Volunteer Gordon Landess works on getting the refuge boat ship-shape for next summer. (MNY-93, S. Ware)

Volunteers manned the office and maintained headquarters facilities while ROS Ware was away at law enforcement training

this winter. They did an outstanding job of maintaining a Fish and Wildlife Service presence and keeping Great Meadows staff informed of problems and significant events throughout the ten weeks.

In August, volunteers again proved their worth when ROS Ware was away for two more weeks of training during the peak of tourist season. Seasoned volunteers provided invaluable assistance with manning the office and conducting daily island patrols, enabling Co-op student Koch to keep things running smoothly during the period.

The refuge volunteer update was distributed to volunteers in early spring. It identified upcoming volunteer opportunities well in advance and allowed individuals to pre-register for activities that interested them. This update proved extremely helpful in integrating volunteers into a variety of projects and in keeping volunteers informed of refuge happenings.

4. Funding

Funding for this satellite is through the Great Meadows NWR budget.

Table E.1- Comparison of Annual Expenditures from 1989 - 1993

Fiscal <u>Year</u>	Refuge Operations <u>(1261)</u>	Refuge Maint. <u>(1262)</u>
93	\$ 57,701.48	\$4346.02
92	\$ 52,286.00	
91	\$ 63,909.00	
90	*	
89	\$ 67,313.00	

* No estimate available

Two equipment donations were received. Chatham resident Larry Giusti donated a 75 lb. mushroom mooring with pennant buoy and Coast Guard Station Chatham transferred two excess wardrobe cabinets to the refuge.

ROS Ware was issued a government Visa credit card in June after completing training provided by the regional budget and finance office.

6. Safety

An annual fire extinguisher inspection was conducted in December.

Co-op student Stephanie Koch contracted poison ivy on both legs and arms after baiting waterfowl traps on South Monomoy on July 28. Advised by her family doctor, she did not work for two days due to the severity of swelling. Workmen's compensation forms for continuation of pay for those days were filed with the State and the regional safety office.

Defensive driving training was provided for staff and two volunteers in July. The National Safety Council instructional video with accompanying study guide was obtained from the regional safety office.

7. Technical Assistance

Refuge staff provided Audubon plover and tern wardens for South Beach with logistical support, primarily in the form of boat transportation. Staff and volunteers also assisted the wardens with posting nesting areas, conducting census's, and setting up predator exclosures. South Beach is a neighboring barrier beach approximately one quarter mile east of North Monomoy. The area had several pairs of nesting piping plovers and sizable colonies of least and common terns. Roseate terns did not nest within the colony as in past years, however.

Refuge staff also assisted Audubon personnel in an annual census of the tern colony on Plymouth Beach. This turned out to be the largest colony in Massachusetts in 1993, and consisted of common, least, roseate, and arctic terns. Staff received valuable training in conducting a large scale nesting tern survey as well as a briefing on the Town of Plymouth's new public use management program.

8. Other

Twenty permits for parking in the refuge's lot adjacent to Stage Harbor were issued. Fishermen requiring access to boats moored in the harbor were the primary users of the lot.

Four permits were issued authorizing shellfishermen to enter specified closed areas on North and South Monomoy for clams, quahogs, and mussels.

One permit was issued to collect horseshoe crabs from tidal flats on North Monomoy. Under this nonconsumptive permit, crabs were collected for a local biological supply company for blood samples and then returned to the refuge. This is the third year harvesting was regulated. (G.11)

Three permits authorizing commercial boat transportation to the Monomoy Islands were renewed. A fourth ferry permit was issued in August, but revoked one month later after staff

learned the permittee was operating without the appropriate Coast Guard Captain's License. (H.16)

A combination of five blanket and trip-specific permits were issued to organizations that conducted natural history tours of the Monomoy Islands for groups of six persons or more. Tour groups were limited to fourteen persons.

F. HABITAT MANAGEMENT

1. General

The 1970 Monomoy wilderness legislation excluded two areas on South Monomoy Island (90 acres at Inward Point and 170 acres near Powder Hole), and the entire Morris Island portion of the refuge (40 acres) from Wilderness designation. Congressional restrictions regarding management of these areas, however, severely limits habitat enhancement activities. Current management consists of regulating guided tours of the islands and seasonally closing areas where wildlife species sensitive to human disturbance are found.

The following closures were implemented in 1993:

NORTH MONOMOY ISLAND:

Area 1 - May 1 through September 30;

Broad Creek and Godwit Bar

Species protected: nesting common terns and laughing gulls (May - August), roosting shorebirds (July - September).

SOUTH MONOMOY ISLAND:

Area 2 - May 1 through Sept. 1 and November 15 through December;

Inward Point

Species protected: nesting piping plovers, common and least terns (May - August), staging terns (July - September), harbor and gray seals (November - March)

Area 3 - May 30 through September 30;

Hospital pond area

Species protected: nesting black-crowned night herons and snowy egrets (May - August), roosting shorebirds (July - September)

Area 5 - Year-round;

Lighthouse ponds

Species protected: nesting and migrant waterfowl

Area 6 - May 1 - September 30;

Powder Hole area

Species protected: nesting piping plovers (May - August), roosting shorebirds (July - September)

2. Wetlands

Saltmarshes, totalling about 154 acres, are located at the north end of South Monomoy, along the west side of North Monomoy, and on the south end of Morris Island. Vegetation consists of regular and short-form saltmarsh cordgrass (Spartina alterniflora) with a broad border of saltmarsh hay (Spartina patens) mixed with saltgrass (Distichlis spicata), black grass (Juncus gerardi) and other occasional herbaceous species. Powder Hole, which in the mid-1800's was a deep and extensive harbor, is now a shallow estaurine water body on the southwest end of the refuge.

The freshwater ponds and marshes, which cover more than 135 acres on South Monomoy, host cattail (Typha angustifolia and Typha latifolia), pond lilies (Nymphaea odorata), and phragmites (Phragmites communis). Big and Little Station Ponds, 27 and 11 acres respectively, are freshwater ponds on South Monomoy originally formed when a bay was closed off by the growth of a recurved spit. Other small freshwater ponds and wetlands dot South Monomoy. Most are natural, but a few lie in depressions bulldozed by the Service in the early 1950's in an effort to increase waterfowl habitat.

3. Forests

On Morris Island, twelve upland acres are forested with woody shrubs and small trees, including bayberry (Myrica pensylvanica), beach plum (Prunus maritima), pitch pine (Pinus ridida), scrub oak (Quercus ilicifolia), and red cedar (Juniperus virginiana).

6. Other Habitats

Nearly a third of the upland area on the refuge is devoid of vegetation. Beachgrass (Ammophila breviligulata) is the most common plant on the refuge. Seaside goldenrod (Solidago sempervirens), dusty miller (Artemisia caudata), beach pea (Lathyrus japonicus), sea rocket (Cakile edentula), and other coastal plants are scattered through the beachgrass. False heather (Hudsonia tomentosa) and lichens (Cladonia spp.) cover many level areas. Woody vegetation is largely restricted to poison ivy (Rhus radicans), bayberry, and beach plum. A few pitch pines, black pines (Pinus thunbergii), and beaked willows (Salix bebbiana), none more than 15 feet high, grow on South Monomoy. There are many large clumps of the exotic salt-spray rose (Rosa rugosa).

9. Fire Management

Negotiations for a cooperative fire suppression agreement with the Town of Chatham were completed. The document was submitted to the Regional Solicitor for legal review in December and is expected to become effective in spring 1994.

12. Wilderness and Special Areas

Ninety four percent of Monomoy's acreage was designated a Wilderness Area in 1970 and is managed under the guidelines of the 1964 National Wilderness Act.

One privately owned summer camp remains in use on South Monomoy Island through a life-tenancy permit issued in 1970.

G. WILDLIFE

1. Wildlife Diversity

Approximately 285 species of birds have been observed on the refuge and 49 species are known to nest here. The variety and great numbers of birds observed year-round make these barrier islands a well-known destination for birders nationwide. The refuge supports only a few species of mammals. Most conspicuous are white-tailed deer, harbor seals, and gray seals.

2. Endangered and Threatened Species

Piping plovers occasionally nest on North and South Monomoy Islands. Large numbers of gulls and human beachgoers pose a significant threat, however. Predator exclosures are used when possible and nesting areas are closed to public entry and patrolled throughout the nesting season. The success of these management efforts is evident by a continued increase in the number of chicks fledged since the program was begun in 1988.

Two breeding pairs and one lone adult, all within the Powder Hole closure on South Monomoy, were tallied during the annual piping plover breeding pair census conducted in June. The total count for the season was four pairs and two unpaired adults.

Nesting activity occurred on two separate areas on South Monomoy. The south end, known as Powder Hole, hosted two pairs of plovers and one unpaired adult. The north end, known as Inward Point, also hosted two pairs and one loner. In summary, three pairs nested successfully and fledged a collective total of eight chicks.

Refuge staff also assisted with plover management on nearby South Beach, providing Audubon-sponsored plover and tern wardens with transportation and technical assistance throughout the nesting season.

Roseate terns utilize the refuge as a major staging area for the fall migration. Up to 75% of the entire northeast population stages there in September. Attempts by roseate terns to nest have been unsuccessful in recent years due to combined predation and harassment by gulls, black-crowned night herons, great horned owls, and short-eared owls. No nesting attempts were noted in 1993.

Peregrine falcons and **bald eagles** are frequently observed using the refuge during spring and fall migrations.

Immature bald eagles were observed in the vicinity of the lighthouse ponds on several occasions throughout the summer and fall.

Peregrines were seen intermittently during the first two weeks of October. Based on staff and volunteer incidental observations, the fall migration seemed especially light. A peak of only two peregrine falcons was recorded in the vicinity of North Monomoy and Morris Island on October 24. Likewise, a peak of two birds was noted on October 6 on South Monomoy. The latest observation of a falcon this year was recorded on November 27 over North Monomoy.

For the third consecutive year, staff assisted Norm Smith (MA Audubon) in his efforts to capture and band migrant peregrine falcons. Trapping, however, was unsuccessful for the first time since the program was initiated. A total of three trapping days, two in October and one in early November, were conducted on South Monomoy Island. A swarm of migrant tree swallows in the area on October 6th, the first trapping day of the season, overshadowed Smith's efforts. Two peregrines and a merlin were spotted that day but neither species showed the least interest in the bait pigeon or starling. Presumably, the birds were stuffed to the gills with swallows! Subsequent trapping days were equally disappointing due to a lack of peregrines migrating through the area.

Several State-listed endangered, threatened, or species of special concern can be found on the refuge:

Least and common terns, listed as species of special concern, often nest on North and South Monomoy Island and utilize both islands as a staging area prior to the fall migration.

The **Northern harrier**, a State threatened species, frequently nests on South Monomoy Island.

Two harrier nests were recorded on South Monomoy this year. A five egg nest was discovered in the vicinity of Powder Hole on May 18, and a seven egg nest was found near the lighthouse marshes on May 29. Fledging success is unknown.

Short-eared owl, a State endangered species, occasionally nest on the Monomoy Islands. These birds are often seen hunting on the refuge in the fall and winter.

One observation of a short-eared owl over Morris Island was made on May 29. No nests or sightings were noted by refuge staff or volunteer birder Blair Nikula during 1993.

The **Sharp-shinned hawk** and **Cooper's hawk** are both listed as species of special concern and are occasionally seen on the refuge during fall migration.

The **least bittern** and **pied-bill grebe**, two State threatened species, are occasionally observed in freshwater ponds on South Monomoy Island along with the **American bittern**, a species of special concern.

Gray seals, a species of special concern, are frequently seen among large numbers of harbor seals on refuge beaches. In 1990, the refuge became the second known pupping site in the state for this species. No cows with pups were seen in 1993. (D.5)

American Sea-blite (Suaeda americana), a plant of special concern in Massachusetts, was identified on South Monomoy Island in 1971.

3. Waterfowl

Monomoy is noted for its large variety of breeding waterfowl species: mallard, Canada goose, American black duck, gadwall, green-winged teal, American wigeon, northern pintail, northern shoveler, blue-winged teal, ruddy duck, and red-breasted merganser. South Monomoy's freshwater ponds and marshes also serve as an important migratory stop-over and wintering area for many waterfowl species.

The shellfish-rich waters around the refuge attract huge concentrations of migrating and wintering seaducks. Extensive eelgrass and sea lettuce beds west of Monomoy provide a food source for wintering and migrating Atlantic brant. As many as 85,000 common eiders utilize the waters off the refuge, as do three species of scoters, red-breasted mergansers, oldsquaw, buffleheads, and common goldeneye.

Eider numbers were noticeably lower than in past winters presumably due to the depleted condition of local mussel beds.

A combination of the lack of birds and cold, windy weather resulted in very little hunting occurring in the waters surrounding the refuge this season.

Brood surveys of the freshwater ponds on South Monomoy (station ponds and lighthouse marshes) using the Bennett Method were conducted on July 1st and 2nd. This is the second year the Bennett Method was utilized. Final waterfowl productivity data based on brood surveys and incidental observations are as follows:

South Monomoy Island: (38 broods total)

	<u># of broods</u>
Black Duck	- 3
Gadwall	- 12
Mallard	- 9
Green-winged Teal	- 6
Mute Swan	- 3
Blue-winged Teal	- 1
Canada Goose	- 2
Pintail	- 2

North Monomoy Island:

*no waterfowl broods observed in 1993

4. Marsh and Water Birds

From 12 pairs in 1980, the Monomoy black-crowned night heron rookery has grown considerably. Nest sites are located in woody vegetation - willow, bayberry, beach plum, poison ivy, and salt-spray rose - on the northern quarter of the south island. A few pioneering pairs began nesting in similar habitat around freshwater ponds to the south in 1987. The black-crowned night herons feed on a variety of prey species including sand lance, mummichog, Fowler's toads, meadow voles, immature gulls, and tern eggs and chicks. Two hundred and twelve night heron nests were tallied during a census of the main heronry on June 23. An additional 25 night heron nests were noted in a small heronry just south of Powder Hole in July.

Snowy egrets, nesting in association with the black-crowned night herons, established themselves on the refuge in 1981. The June 1993 census recorded 72 egret nests in the main South Monomoy heronry. In addition, four glossy ibis nests were found among a small group of nesting night herons just south of Powder Hole.

Great blue herons and great egrets use the refuge throughout the spring, summer and fall.

5. Shorebirds, Gulls, Terns and Allied Species

The refuge is an important staging area for shorebirds. Approximately 24 shorebird species pass through during the fall migration, stopping to feed and rest along the tidal flats of North Monomoy, Inward Point and Powder Hole. The refuge is one of the few stops made by the Hudsonian godwit between Hudson's Bay and South America.

Sanderlings are the most abundant shorebird on the refuge. Black-bellied plovers, semipalmated sandpipers, and short-billed dowitchers are also very common.

Three shorebird species, willet, piping plovers (G.2), and American oystercatchers, nest on the refuge. Eleven pairs of nesting oystercatchers, eight on South Monomoy and three on North Monomoy, were noted during the annual piping plover census of the islands. A total of seven willet nests on North Monomoy were recorded during the annual tern census.

A census of the North Monomoy tern colony was conducted on June 10. An all time low of 43 common tern nests was recorded along with 13 laughing gull nests. Several herring gull nests discovered in the middle of the colony during the census were noted and destroyed. Although herring and black-backed gulls regularly nest along the periphery of the tern colony, this is the first year they were found nesting among the terns.

Following the annual survey, nesting terns and laughing gulls were monitored periodically for productivity. The laughing gulls abandoned the site by June 27. Common terns actually increased in number in late June, coinciding with the break up of a large colony on nearby South Beach. North Monomoy picked up about 50 additional pairs of common terns, bringing the total up to 93 nesting pairs for the season. By August 15, only two or three downy chicks had been observed within the colony. Numerous empty nests, nests with shell fragments, and nests with eggs still intact were also noted on this date. No young are believed to have fledged from this colony.

The North Monomoy tern colony was spread out over a series of low, sparsely vegetated hummocks and ridges located just above the high tide line on the west side of the island. Nesting laughing gulls were concentrated on the most significant hummock found at the northwest end of the island.

On June 19, approximately twelve pairs of least terns and six common tern pairs were observed making scrapes on the upper beach just outside of a closed area on South Monomoy at Inward Point. Neither of these species has nested on South Monomoy in several years and this discovery was a surprise so late in the season. These prospecting birds were presumably from a

large colony that was breaking up due to harassment from predators on nearby South Beach. Closed area signs were extended southward to include the new colony on June 20. Least terns abandoned nesting efforts by June 28. Several downy common tern chicks were observed within the colony on August 26. It is unknown if any young fledged.

Recent history of gull nesting on Monomoy started with five pairs of herring gulls in 1963 (Kadlec and Drury 1968). The colony growth in successive years was exponential. By 1980, herring gulls had increased to 14,500 nesting pairs. Great black-backed gulls moved onto Monomoy soon after the herring gulls and their population increased from 0 to 3,300 pairs during the same time period. The most recent estimate of 17,775 gull pairs (herring gull=9,594 pairs; black-backed gull=8,181 pairs) is based on a census of both islands in 1990.

Herring and great black-backed gulls continued to thrive on both North and South Monomoy Islands. As in past years, loafing gulls were a problem for other nesting species. Areas suitable for piping plover, common and least terns were often roosts for hundreds of gulls. Due to the size of the area involved and manpower requirements, a complete survey of the Monomoy gull colony is done only once every five years. Periodic surveys of nesting gulls on North Monomoy are conducted in addition to the five-year census of the entire refuge when assistance is available.

Gull-free buffer zones around nesting plovers and terns were maintained by destroying black-backed and herring gull nests and shooting adult birds within designated areas. These management efforts are identified in the Refuge Master Plan and were conducted under a Federal Fish and Wildlife Depredation Permit and a Massachusetts Collecting Permit. The local USDA APHIS/ADC representative was also contacted regarding the depredation permit.

A black-tailed godwit was discovered by Volunteer Blair Nikula on North Monomoy Island on June 23. Normally found in Eurasia, this bird has been recorded in the continental United States on only a few occasions. This was the first sighting ever recorded on the refuge.

All four species of godwits have now been recorded on North Monomoy. Both Hudsonian and marbled godwits are regular fall migrants, Hudsonians sometimes peaking at over a hundred birds in early August, and marbleds numbering up to eight birds in early September. Bar-tailed and black-tailed godwits are very rare. There have been about ten sightings of bar-taileds on North Monomoy in the last twenty years, the most recent during

the summer of 1992 when two individuals showed up, one of which stayed into October.

6. Raptors

Bald eagles and peregrine falcons are seen on the refuge during spring and fall migration, and both have been observed in winter along with an occasional snowy owl. A variety of other raptors can be seen on Monomoy during migration, including cooper's hawk, sharp-shinned hawk, and the American kestrel.

A great horned owl nest with one young was discovered near the lighthouse on South Monomoy on May 18.

An unusual observation of a golden eagle over South Monomoy was made by Great Meadows Bio-Tech Burke on May 27.

7. Other Migratory Birds

The refuge provides nesting habitat for many species of passerines: red-winged blackbirds, song, sharp-tailed and savannah sparrows, horned larks, common yellowthroats, and yellow warblers, and several others. Blue jay, robin, towhee, grackle, rough-winged swallow and kingfisher nest on the Morris Island portion of the refuge. Numerous warblers and other land birds which migrate over water utilize Monomoy as a stopover during migration, especially in the fall.

Ten songbird nesting boxes are maintained on Morris Island.

8. Game Animals

The white-tailed deer population on the islands remains fairly constant at 15-25 individuals. Limited amounts of quality browse serves as a natural population control. An aerial census was not conducted in 1993.

9. Marine Mammals

Harbor and gray seals frequently use the eastern shore of South Monomoy Island as a haul-out site during the winter months and can be observed feeding in the waters offshore of the refuge at high tide.

Harbor seal numbers for the year peaked at approximately 1000 individuals on March 10. The wintering gray seal population also peaked in late March at an estimated 50 animals.

Gray seals did not pup on South Monomoy this January as in years past. Yearling gray seals were observed among hauled out adults on several occasions in March, however. (D.5)

Two dead adult seals, a gray on Morris Island in early May and a harbor on Inward Point in July, were recovered on the refuge.

A newborn harbor seal was found on Morris Island on May 27. After observing it for 24 hours, the abandoned pup was brought to the New England Aquarium.

As in past years, a number of gray seals were frequently observed using the south end of nearby South Beach, owned by the town of Chatham, as a haul-out site. The presence of the seals during the peak tourist and boating season was both exciting and distressing. Easy foot and boat access resulted in almost constant disturbance of basking seals during the day. In addition, several marinas and ferry services conducted daily seal cruises throughout the summer after completing their usual winter/spring cruise program. Through it all, however, the seals toughed it out and were often seen waiting just offshore for boaters and pedestrians to leave so they could reclaim their haul-out beach.



For the past two summers, the presence of gray seals on nearby South Beach delighted tourists and local ferry operators. (MNY-93, B. Tague)

10. Other Resident Wildlife

Monomoy's small terrestrial mammals, which include masked shrew, short-tail shrew, white-footed mouse, muskrat, meadow jumping mouse, and meadow vole, serve as prey for the refuge's raptors. The meadow vole is the most abundant small mammal.

A population of Fowler's toads is found on North and South Monomoy Islands.

11. Fisheries Resources

Each spring thousands of horseshoe crabs congregate in the saltmarshes of the islands to breed and lay their eggs, providing an important food source for shorebirds and some colonial nesting waterbirds. Local fishermen who use the crabs as bait in lobster pots and conch traps benefit from this annual event as well. Due to concerns about consumptive harvesting pressures, a permit system for harvesting crabs on the refuge was instituted in 1990. Currently, there is only one permittee. This individual provides live crabs to the Associates of Cape Cod, a biological supply house located in Woods Hole. The crabs are returned to the refuge by the permittee after blood samples are taken. Horseshoe crab blood is the key ingredient in a biochemical test for bacterial toxin developed and distributed by the lab.

The sand eel or sand launce, a small fish abundant in the waters surrounding the refuge, serves as an important food source for many larger fish and colonial waterbirds nesting on the refuge.

14. Scientific Collections

Four common loons salvaged from refuge beaches throughout the winter/spring months were provided to the Wildlife Clinic at Tufts University School of Veterinary Medicine for analysis. The birds became part of an ongoing study being conducted by Dr. Pokras on the causes of mortality of common loons in New England.

15. Animal Control

Gull-free buffer zones around nesting piping plovers and terns were maintained by destroying black-backed and herring gull nests and shooting adult birds within designated areas. These management efforts are identified in the Refuge Master Plan and were conducted under a Federal Fish and Wildlife Depredation Permit and a Massachusetts Collecting Permit. The local USDA APHIS/ADC representative was also contacted regarding the depredation permit. (G.5)

16. Marking and Banding

Efforts to capture and band migrant peregrine falcons this fall were unsuccessful. (G.2)

Pre-season waterfowl banding was not conducted this year due to a staff training conflict. The new banding schedule

program from Patuxent Lab, however, was installed on the station's computer in preparation for the 1994 banding season.

H. PUBLIC USE

1. General

Monomoy NWR is located in the town of Chatham, approximately 75 miles southeast of Boston. The refuge consists of two barrier beach islands, known as North and South Monomoy, and a forty acre parcel on the mainland located on Morris Island. The refuge headquarters/visitor contact station is located on Morris Island. An outdoor, portable restroom facility is available year-round.

Cape Cod is a popular vacation destination. The summer population in the Town of Chatham alone was estimated to be 20,000 in 1990, almost three times the winter figure. The summer peak population for the entire Cape was estimated at 447,000 for 1990 and is expected to reach 500,000 by the year 2000.

Access to North and South Monomoy is by boat only. Visitors arrive by private vessel or aboard commercial tour boats. Visitor use is restricted to protect wildlife and habitat in accordance with the Refuge's Wilderness Area designation and Master Plan. Large "Open Beach" signs are used on North and South Monomoy to direct recreational boaters to beach areas away from nesting birds. Tern and plover nesting areas, seal haul-out beaches, and shorebird roosting and feeding areas are seasonally closed to public entry.

Approximately 17,000 people visited the refuge this year, 13,677 during the summer/fall tourist season. While the total visitation remained similar to that recorded in 1992, public use during the summer months was noticeably greater than in past years. An extended stretch of dry and sunny weather in July and August, as well as the presence of an extremely rare black-tailed godwit on North Monomoy in late June, brought increased numbers of tourists and birders to refuge beaches and trails. The number of boaters visiting the islands during the weather-perfect July Fourth weekend was incredible! An estimated 100 boats anchored off the Monomoy Islands each day of that holiday weekend. Use of the mainland portion of the refuge was also substantial. No estimate is available, however, as staff focused primarily on patrolling the islands.

Captain Keith Lincoln operated the only commercial ferry to the islands. Captain Lincoln ferries incidental visitors as well as bird clubs and other environmental organizations. Service was available from June through August, peaking in late June when hordes of birders traveled to North Monomoy for

a look at the transient black-tailed godwit. The total number of visitors ferried to the islands was 800:

North Monomoy Island - 800 visitors
South Monomoy Island - 18 visitors

Guided birdwatching tours of the refuge were conducted by Audubon and the Cape Cod Museum of Natural History. The season ran from April through November. The total number of visitors who participated in the tours was:

North Monomoy Island - 906 visitors (105 tours)
South Monomoy Island - 112 visitors (14 tours)

Both groups also conducted seal cruises around the refuge and neighboring South Beach. Two hundred and thirty-eight people over the course of thirty cruises between February and April viewed wintering seals and learned of their life history.

4. Interpretive Foot Trails

A 3/4 mile loop trail is available on Morris Island. Recent erosion has significantly narrowed a section of beach at the head of the trail, however, restricting access during high tides. To discourage visitors from trespassing on adjacent private beachfront property, the trail is closed approximately three hours a day, one hour before high tide until one hour after. Numbered sites along the trail are interpreted in a leaflet available on-site. In addition, several trail side panels offer inquisitive hikers information on a sampling of wildlife species and habitats.

A three panel kiosk located adjacent to the visitor parking area on Morris Island orients visitors to the refuge and the Service when the visitor contact station is closed.

Stairs leading to the beach were reinforced with additional cement pilings and re-opened to the public in June. The stairs had been weakened by the December 1992 northeaster storm. While the stairs were out of commission, visitors were directed to use an alternate sand trail to access the beach.

The "Birder's trail" on North Monomoy is actually a 20' wide corridor that runs between two large seasonally closed areas. This corridor allows visitors the opportunity to observe species that are nesting, feeding, or roosting within the closed areas from a distance that is tolerated by the birds. The northern end of North Monomoy is a historic common tern and laughing gull colony site, while the remainder of the island is used extensively by shorebirds throughout the summer and fall.

6. Interpretive Exhibits/Demonstrations

The office/visitor contact station is open year-round and hosts a branch outlet of the SuAsCo/Great Meadows NWR bookstore. A saltwater aquarium, various taxidermic mounts, framed wildlife photos and posters are also on display.

7. Other Interpretive Programs

The Monomoy Lighthouse Complex, located on South Monomoy Island, is listed on the National Register of Historic Places. It was built in 1849 and manned by the U.S. Coast Guard until 1923. The lighthouse was owned privately until acquired in 1964 by the Massachusetts Audubon Society, who used it as a base camp for conducting birding tours until it was acquired by the Service in 1972. Having been extensively vandalized, it was restored in 1988 with funding secured partly through the Bicentennial Lighthouse Fund and other Federal sources. Guided tours are currently conducted by the Cape Cod Museum of Natural History under a cooperative agreement with the Fish and Wildlife Service. (J.1)

1993 marks the fifth year of the Museum's use of the historic Monomoy Light as a base for conducting cultural and natural history tours. A total of twenty-eight visitors participated in five tours this fall. Only one tour (five participants) included an overnight stay at the lighthouse keeper's residence. Inclement weather resulted in many cancelled tours, especially during the fall months.

Wildlife Week Teacher Kits produced by the National Wildlife Federation were distributed to nearly 100 Cape Cod teachers and scout leaders in March and April. This is the second year the kits were offered at the refuge.

9. Fishing

Striped bass, fluke, flounder, and bluefish are popular catch for surf fishermen on Morris Island and North and South Monomoy Islands. Bass, bluefish, and fluke populations peak in late summer.

Intertidal marine flats near Powder Hole, Inward Point, Godwit Bar, Common Flats, and Morris Island are an important source of quahogs, softshell clams, and mussels for local shellfishermen.

11. Wildlife Observation

Monomoy is famous as a hot spot for birding. Concentrations of shorebirds, terns, waterfowl, seals, and many other species attract wildlife enthusiasts year-round.

16. Other Non-Wildlife Oriented Activities

Sun bathing and swimming, though not encouraged, are popular activities on and around the refuge. Popular areas include the beaches of Morris Island, the east side of North Monomoy, and Powder Hole. Two, large "Open Beach" signs are used to direct visitors to areas among these popular spots that pose the least amount of disturbance to nesting and feeding birds.

17. Law Enforcement

Shellfishing in Powder Hole was popular this summer and fall making enforcement of the closure of the adjacent beach for nesting piping plovers especially troublesome. Although some contacts were made in the field, usually the only evidence of shellfishermen trespass were tell-tale footprints and drag lines in the sand on the outer beach. Fortunately, no incidences of inadvertent destruction of plover nests occurred. A seasonal Town shellfish warden provided some assistance with patrolling this area on weekends. In addition to enforcing Town regulations on nearby tidal flats, the warden took the initiative to contact shellfisherman observed within the refuge's posted closed area. Refuge staff learned of this individual's enforcement efforts when he mistook them for shellfishermen!

One duck hunter was found illegally on the refuge in December. The individual allegedly only intended to cross refuge property with his loaded shotgun to hunt adjacent town property on the point. The individual was informed of refuge regulations and he cooperatively unloaded his firearm and retraced his steps to exit the refuge.

Eider numbers were noticeably lower this winter presumably due to the depleted condition of local mussel beds. A combination of the lack of birds and cold, windy weather resulted in very little hunting occurring in the waters surrounding the refuge this season.

One incident of unauthorized shooting on South Monomoy was reported by a local shellfisherman in August who frightened the three individuals off at his approach.

Approximately 90% of staff time during the summer months was devoted to patrolling closed areas on the islands. Visitors contacted within closed areas were usually quite understanding and cooperative. Incidences of dogs being on the islands, and unleashed on the Morris Island portion of the refuge, were frequent in July and August. An estimated average of four dogs per weekend day were found on the islands by staff, often in the vicinity of piping plover nesting areas. Dog owners usually complied with refuge regulations after threats to

nesting and feeding birds were patiently pointed out. Kite flying, camping, and evening beach parties were also popular activities discouraged by frequent patrols and "educational" enforcement contacts. No citations were issued in 1993.

After operating illegally for three seasons, Captain John McGrath finally complied with regulations and received a refuge permit on August 5 authorizing his water taxi service to North and South Monomoy. His permit was revoked on September 23, however, after staff learned he did not possess a Captain's License for commercial boat operation outside of the harbor. The U.S. Coast Guard Marine Safety Office subsequently launched an investigation of McGrath's water taxi business and a hearing is pending.

18. Cooperating Associations

A branch outlet of the SuAsCo/Great Meadows NWR bookstore continued operation at the Morris Island refuge headquarters. Refer to section H.18 of the Great Meadows NWR Narrative Report for a listing of sales items and summary of annual sales.

I. EQUIPMENT AND FACILITIES

3. Major Maintenance

The steering cable on the station's Aquasport boat failed in October and was replaced.

The fuel on the station's Boston Whaler outboard engine was replaced in May.

A 1987 Chevrolet S-10 truck from Great Meadows NWR was transferred to the Monomoy NWR fleet in February and outfitted with new tires in December.

The cab and front end of the station's 1989 Chevrolet one ton truck were re-painted by a local Chevy dealer in November. Although there was no factory recall on record for this vehicle, Chevrolet painted the truck free of charge after dealer representatives conducted an inspection and found the paint severely de-laminated in several areas.

The shower stall at refuge headquarters was replaced by RM Moses with a new unit donated by Coast Guard Station Chatham in May.

Volunteers installed a new sign identifying refuge headquarters in February.

An excess five-drawer filing cabinet was acquired from the Regional Office in October.

Volunteers and staff shored up storm-damaged beach stairs with additional cement pilings in June. The stairs, which serve as the main beach access for visitors to the Morris Island portion of the refuge, were re-opened following the repairs.



Great Meadows Bio-Tech Burke gave Monomoy staff and volunteers a helping hand with repairing storm-damaged beach stairs on Morris Island this spring. (MNY-93, S. Ware)

Volunteer carpenter Todd Seastedt replaced the front door on refuge headquarters with a new, weather-tight unit in July.

8. Other

RM Moses replaced patches of missing and loose roof shingles on refuge headquarters on several occasions. This patch work has become a quarterly chore due to strong fall winds and

winter storms. Funded IPW's for FY94 thankfully include a complete roof replacement.

Updates concerning the opening of a regional facility for the National Weather Service and the anticipated consolidation of field stations throughout New England appeared in local papers on several occasions. According to the media, the Chatham weather station will be moved to the regional facility in Taunton sometime between June and August of 1994. Weather station employees indicate that when the station is closed, a private contractor will be brought in to continue launching weather balloons at the Chatham site.

If and when the Chatham station is closed, the refuge is hoping to convert the administration building into a visitor center and staff offices. Thus far, the Weather Service has not contacted the refuge regarding the upcoming closing of their station or removal of existing underground fuel tanks, both of which are located on refuge property.

J. OTHER ITEMS

1. Cooperative Programs

The Cape Cod Museum of Natural History, operating under a cooperative agreement enacted in 1989, conducted guided natural history and cultural history tours of the Historic Monomoy Light and Keeper's residence on South Monomoy Island. (H.7) Under the agreement, the Museum has primary responsibility for maintaining the Light and Keeper's Residence.

A joint annual inspection of the lighthouse facility, called for under the terms of the agreement and re-scheduled on several occasions due to inclement weather, was not accomplished in 1993. Museum staff and volunteers spent several days at the lighthouse this summer, however, accomplishing a variety of minor painting and general clean-up projects.

Journalist North Cairn, a freelance writer for the Cape Cod Times, spent four consecutive weeks at the Keeper's residence during late August and early September. She was granted special permission from Museum administrators to "experience the wilderness" of Monomoy and write a story about it for the 50th anniversary edition of the Museum's annual magazine. During her stay at the lighthouse, Cairn also published a series of articles in a weekly column entitled "A Month On Monomoy". The well-written and researched articles covered a variety of topics related to refuge management programs, nesting endangered species, and her daily experiences and encounters.

In accordance with the Refuge Revenue Sharing Act, the Town of Chatham was presented \$33,100.00 in fiscal year 1993. RM Moses personally presented the check to Town Selectmen in July.

4. Credits

The 1993 narrative was prepared by Refuge Operations Specialist Ware, edited by Refuge Manager Moses, and assembled by Donna Surabian, Administrative Assistant for Great Meadows NWR.

INTRODUCTION

Nantucket National Wildlife Refuge is found at the tip of Great Point on Nantucket Island in Massachusetts. It consists of 40 acres of beach and dune habitat and was established through a land transfer from the U.S. Coast Guard in 1973.

Several species of shorebirds and raptors utilize the refuge, as well as small numbers of harbor and gray seals. Piping plovers regularly nest on adjacent beaches and are occasionally observed feeding on the refuge. The waters immediately offshore are frequented by bluefish and striped bass during the summer and fall, making refuge beaches a favorite with surf fishermen.

The refuge is managed under a cooperative agreement with the Trustees of Reservations, a local non-profit conservation agency that owns and manages property adjacent to the refuge.

Nantucket Light, operated and maintained by the U.S. Coast Guard, is the only man-made structure found on the refuge.

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Nantucket National Wildlife Refuge

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K. FEEDBACK

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L. INFORMATION PACKET - - - (inside back cover)

A. HIGHLIGHTS

Vehicle access to Great Point was restricted to accommodate nesting terns and plovers. (H.15)

Trustees of Reservations conducted guided tours of the refuge as well as their adjacent property known as the Coskata-Coatue Refuge. (H.5)

B. CLIMATIC CONDITIONS

*Refer to the Monomoy NWR Narrative for details.

E. ADMINISTRATION

1. Funding

Nantucket NWR is an unstaffed satellite administered by Great Meadows NWR.

G. WILDLIFE

1. Wildlife Diversity

The refuge provides habitat for wintering black ducks, Canada geese, and a variety of sea ducks including eider, scoter, and oldsquaw. A small population of blacktail jackrabbits, a species introduced to the Great Point area several decades ago, can be found year-round. Small numbers of gray and harbor seals use refuge beaches as a haul-out in the winter.

Habitats found on the refuge consist of sandy beach and dunes with low shrub vegetation. The dominant plant species is American beachgrass. Dispersed patches of bayberry and beach heather are the only other common plant species.

2. Endangered and Threatened Species

Piping plovers, a federally threatened species, are occasionally seen feeding along the tidal rack-line on refuge beaches.

Trustees plover warden Tina Whitman monitored nesting birds on the refuge. Although piping plovers were occasionally observed feeding on the refuge, nesting did not occur. The highlight of plover activity occurred in July when a family of plovers spent two days feeding on refuge beaches before returning to their original nesting territory on adjacent property.

Short-eared Owls and **northern harriers**, listed by the State as an endangered species and a species of special concern, respectively, are frequently observed hunting on the refuge.

One harrier nest was recorded approximately one half mile south of the refuge boundary on the Coskata-Coatue Refuge.

Gray seals, a species of special concern in Massachusetts, haul-out on refuge beaches in the winter months.

5. Shorebirds, Gulls, Terns, and Allied Species

Common, and least terns are common in the summer months. Loafing herring gulls and black-backed gulls are abundant on the refuge throughout the year.

The Trustees plover warden conducted a census of nesting gulls in May. Six herring gull nests and nine black-backed gull nests were found on the refuge.

H. PUBLIC USE

1. General

Total visitation was estimated to be 20,000 for the one hundred day tourist season, May through October. Picnicking, fishing, and birdwatching were the most popular activities.

An average of 50 vehicles per day, primarily surf fishermen, accessed the refuge using a designated route across adjacent property owned by the Trustees. This represents an estimated 20% decline from 1992 figures due to access restrictions instituted during the nesting season. In addition, an estimated 24 visitors made the five mile hike to access refuge property on the point. Virtually no visitation occurs in the off-season.

7. Other Interpretive Programs

Approximately 750 people participated in a series of guided wildlife walks conducted by naturalists with the Trustees of Reservations. This was the first year tours were conducted of the refuge as well as on adjacent property known as the Coskata-Coatue Refuge. The program offered visitors alternative access to the area in response to new restrictions on vehicle access instituted by the Trustees this year.

9. Fishing

The refuge is a popular haunt for surf fishermen seeking striped bass and bluefish. As many as 100 fisherman a day work the area in August and September.

15. Off-Road Vehicling

Vehicle access across the Trustees property to the refuge was reduced by about 20% from previous years due to new regulations instituted during the nesting season. Vehicle access was restricted from June 15 through August 15.

J. OTHER ITEMS

1. Cooperative Programs

A cooperative agreement with the Trustees of Reservations renewed in December. Under this agreement, the Trustees are responsible for monitoring plover and tern nesting activity, posting seasonal closed areas, and re-routing vehicle access as necessary. They also maintain refuge boundary signs and keep refuge staff informed of important events.

Nantucket Light, operated and maintained by the U.S. Coast Guard, currently sits on a 10,000 sq.ft. inholding. The original lighthouse was lost in a severe storm in 1984 and was rebuilt by the Coast Guard in 1986.

In accordance with the Refuge Revenue Sharing Act, Nantucket Island received \$2,437.00 from the Service for fiscal year 1993.

4. Credits

This report was updated by Refuge Operations Specialist Ware, edited by Refuge Manager Moses, and assembled by Administrative Assistant Donna Surabian.

INTRODUCTION

Massasoit National Wildlife Refuge was established in 1983 to protect a small population of the endangered red-bellied turtle. The refuge consists of 184 acres in Plymouth County, Massachusetts and is closed to all public use. Turtle research is ongoing as are efforts to protect and enhance habitat to increase successful reproduction. The refuge is managed cooperatively with the Massachusetts Division of Fisheries and Wildlife.

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Massasoit National Wildlife Refuge

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K. FEEDBACK

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- L. INFORMATION PACKET - - - (inside back cover)

A. HIGHLIGHTS

Graduate Student Allison Haskell collected data on turtles on Crooked Pond for her Masters Thesis. (D-5)

B. CLIMATIC CONDITIONS

Refer to the Great Meadows NWR 1993 Narrative for details.

D. PLANNING

1. Master Plan

Management and research efforts are guided by a master plan developed in 1984.

5. Research and Investigations

Dr. Terry Graham of Worcester State College monitored red-bellied turtles (*Psuedemys rubriventris bangsii*) throughout Plymouth County under a cooperative agreement with the Massachusetts Division of Fisheries and Wildlife. When working on the refuge, Graham and his assistants utilize a small cabin that overlooks Crooked Pond, the primary turtle breeding pond, as a base of operations.

In 1991 Graham's research indicated the red-belly population in Crooked Pond had reached carrying capacity and discontinued the release of head-started turtles on the refuge. No trapping was conducted on the refuge this season.

Graduate Student Alison Haskell completed her monitoring study of turtles on the refuge this summer. Her observations will be used by the Service's Endangered Species Office to evaluate and update the recovery plan for this species.

E. ADMINISTRATION

1. Personnel

Massasoit is an unstaffed satellite administered by Great Meadows NWR.

5. Funding

Research funding is provided by the State through a cooperative agreement with the Service's Endangered Species Program.

8. Other

Recovery of the red-bellied turtle is the primary goal of the refuge and turtle protection, research, and management take precedence over all other activities. Incidental benefits to other wildlife species result from protection of habitat through Federal ownership and regulation. The refuge is closed to all public use.

G. WILDLIFE

1. Wildlife Diversity

A variety of upland mammals, birds, reptiles and amphibians associated with pine barrens habitat are found on the refuge. Due to the absence of wildfires in recent years, the habitat is undergoing a slow transition to a closed canopy forest of scarlet, black, and white oak.

2. Endangered and/or Threatened Species

Red-bellied Turtles nest along the sandy shoreline of Crooked Pond, a ten acre freshwater pond found on the refuge.

Two plants identified as species of special concern by the Massachusetts Natural Heritage Program, **Terete Arrowhead (Sagittaria teres)** and **Wright's Panic Grass (Dichanthelium wrightianum)**, are also found along the shores of refuge ponds.

I. EQUIPMENT AND FACILITIES

8. Other

A small cabin overlooking Crooked Pond is maintained for turtle researchers.

J. OTHER ITEMS

1. Cooperative Programs

Massasoit NWR is managed primarily by the State under a Memorandum of Agreement with the Massachusetts Division of Fisheries and Wildlife. This agreement was established in 1984 and updated in 1989.

Under the agreement, the State has responsibility for maintaining boundary posting, monitoring wildlife use of the area, and conducting law enforcement patrols as necessary.

In accordance with the Refuge Revenue Sharing Act, the Town of Plymouth was presented a check for \$5,450.00 for fiscal year 1993.

4. Credits

This report was updated by Refuge Operations Specialist Ware, edited by Refuge Manager Moses, and assembled by Administrative Assistant Donna Surabian.